SOME OPTIONS FOR THE FUTURE OF SATELLITE OBSERVATIONS OF THE GLOBAL WATER CYCLE

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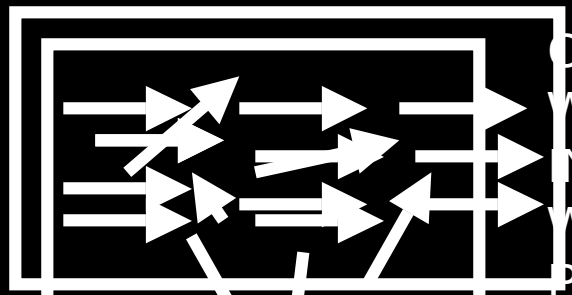
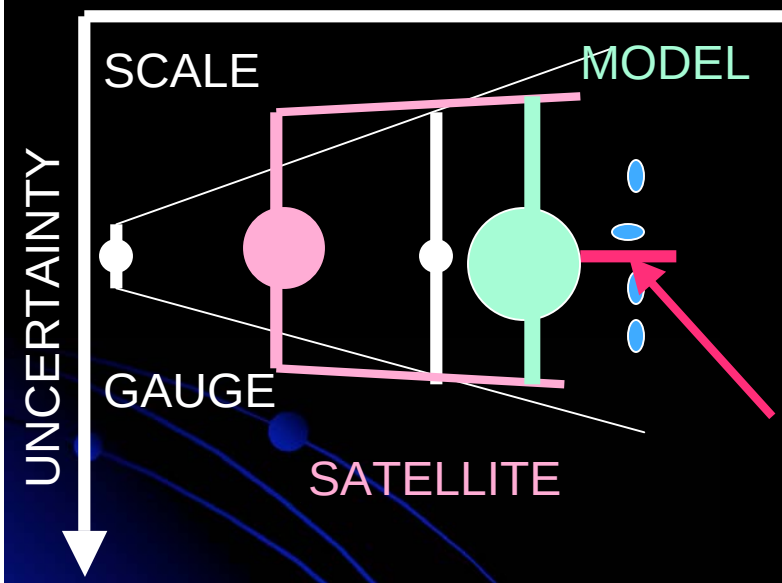
MUSINGS BASED ON DISCUSSIONS HERE

WE NEED AN OVERALL SCIENTIFIC VISION FOR WATER CYCLE OBSERVATION ACTIVITIES.



CURRENTLY:
WE MAY INADVERTENTLY WORK AT CROSS PURPOSES.

A VISION CAN SERVE AS A "WAVE GUIDE" TO BRING COHERENCE TO OUR EFFORTS.



PERHAPS THE TIME HAS COME TO TREAT OBSERVATIONS AS ENSEMBLES – USING THE ERROR CHARACTERISTICS OF THE OBSERVATIONS AT DIFFERENT SCALES.

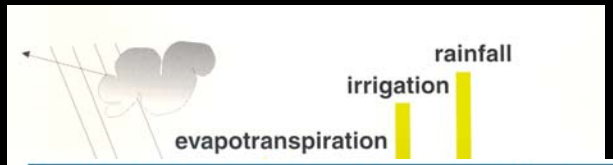
WANTED: AN ENSEMBLE MEAN FOR A SPECIFIC SCALE WEIGHTED BY MEASUREMENT (AND MODEL) TYPE.

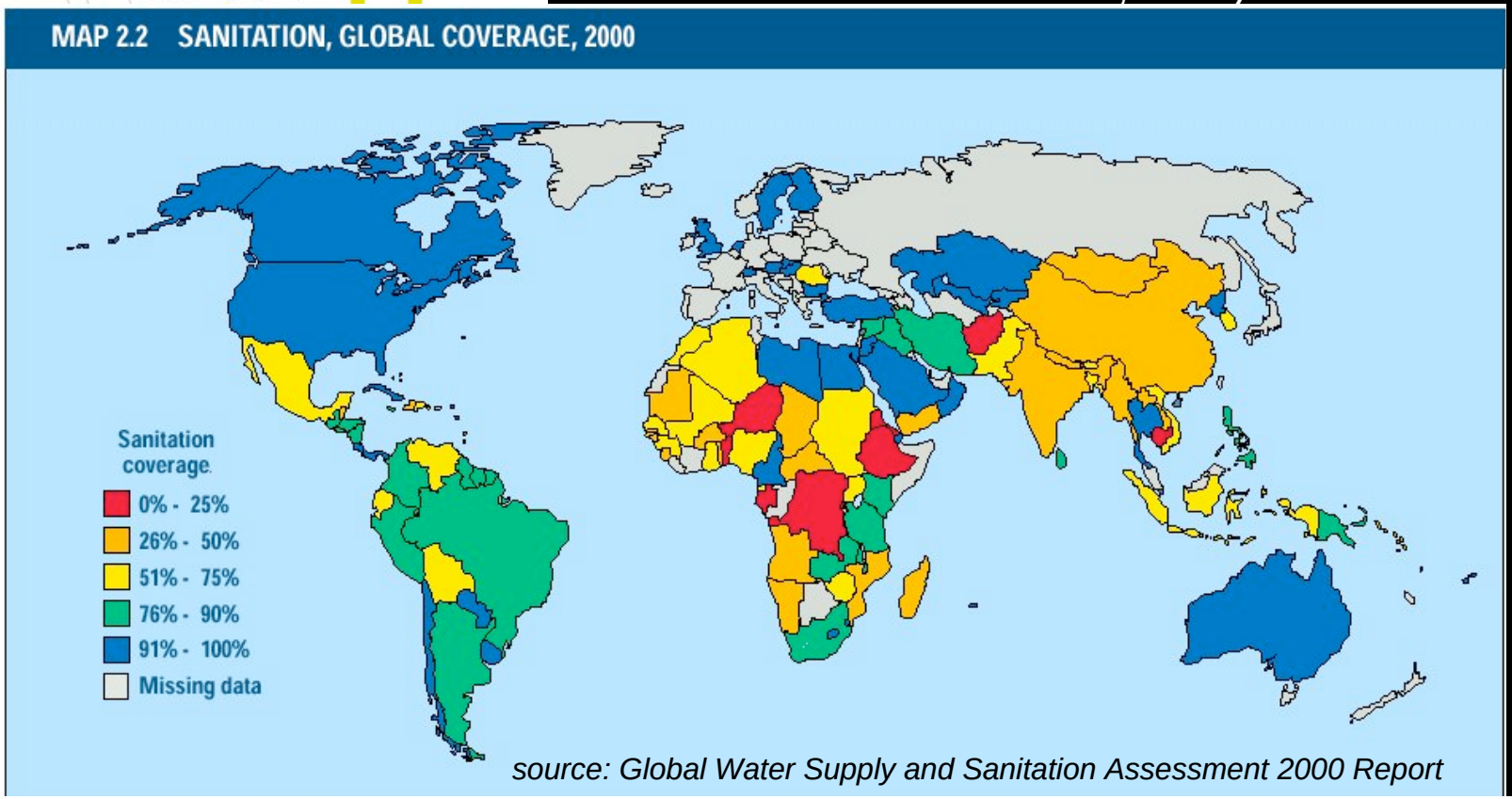
SATELLITE DATA SHOULD BE USED IN PROCESS STUDIES WHICH IN TURN COULD BECOME AN IMPORTANT COMPONENT OF VALIDATION STRATEGIES

HOWEVER WE NEED TO REALIZE THAT 0-ORDER VALIDATION HAS BECOME AN IMPORTANT ARGUMENT FOR DOING IN-SITU OBSERVATIONS SO THERE MAY BE IMPLICATIONS OF FORSAKING 0-ORDER VALIDATION.

WE CAN SIMULATE SOME OF THE HUMAN ASPECTS OF THE GLOBAL WATER SYSTEM BY SMART PARAMETERIZATIONS.

BUT PARAMETERIZATIONS CAN ONLY TAKE US SO FAR – THERE ARE ISSUES THAT WE CANNOT ADDRESS INVOLVING HUMAN BEHAVIOR BASED ON INDIVIDUAL AND COLLECTIVE BEHAVIOR (CULTURE, ECONOMICS, ETC)





source: Global Water Supply and Sanitation Assessment 2000 Report

IN OUR DISCUSSIONS IT IS EASY TO BELIEVE WE KNOW THE ANSWERS – BUT DO WE?

IDEAL WORLD	REAL WORLD
WATER IS SUCH A KEY ISSUE THAT GOVERNMENT WILL PROVIDE MONEY FOR WC SATELLITE SYSTEMS IF WE MAKE A CASE	THE FEDERAL GOVERNMENT IS HAPPY TO LOOK TO THE STATES TO TAKE RESPONSIBILITY FOR MANAGING WATER.
THE US SHOULD PICK UP ALL OF THE EARTH OBSERVATION REQUIREMENTS TO LOOK AT THE WATER CYCLE.	THE US SPACE PRIOIRITIES AND FINANCIAL SITUATION WILL REQUIRE THE US TO COLLABORATE WITH OTHER NATIONS.
ONE ELITE GROUP (MY GROUP) SHOULD HAVE ACCESS TO DATA AND CAPABILITY (AND MONEY) TO DO THE ANALYSIS AND ASSIMILATION NEEDED TO DEVELOP THE BEST TIME SERIES OF WATER CYCLE VARIABLES.	NO SINGLE GROUP IS LIKELY TO HAVE ALL OF THE COMPONENTS WE NEED TO DEVELOP THE BEST TIME SERIES. GROUPS AND INDIVIDUALS NEED EACH OTHER. WE NEED TO LEARN FROM EACH OTHER.

IDEAL WORLD

WE COULD FREEZE THE PLANS AT SOME POINT IN TIME (E.G DECADAL SURVEY) AND NOTHING WOULD CHANGE FOR A DECADE.

WE COULD SUCCESSFULLY ARGUE THE NEED FOR BETTER SATELLITE OBSERVATIONS IN TERMS OF SCIENTIFIC PROBLEMS THAT WE NEED TO ADDRESS.

WE WILL USE AN INTEGRATED APPROACH TO SOLVE WATER CYCLE QUESTIONS.

REAL WORLD

AGENCY BUDGETS WILL BE IN A STATE OF FLUX AND UNLESS WE GIVE AGENCY MANAGERS PLANS FOR NEW INITIATIVES THE BUDGET WILL CONTINUE TO BE WHITTLED AWAY.

WE WILL NEED TO SHOW HOW THE SCIENCE WE WISH TO DO LINKS WITH APPROVED AND PLANNED MISSIONS BECAUSE SUPPORT (AT LEAST FROM NASA) MAY BE VERY LIMITED UNLESS THERE ARE CLEAR LINKS.

THE FUNDING SYSTEM ENCOURAGES US TO STAY IN OUR SPECIALTY BOX FOR SURVIVAL.

WHERE SHOULD WE GO FROM HERE?

1. WHERE COULD WE GO FROM HERE?

2. ON WHAT BASIS WOULD WE SCREEN OUR OPTIONS?

3. HOW SHOULD WE PURSUE THE SELECTED THE PATH?

WHERE COULD WE GO FROM HERE?

1. WE COULD LOBBY FOR THE FULL IMPLEMENTATION OF THE DECADAL SURVEY.

2. WE COULD PURSUE AN AGREED UPON VISION AND PROJECT SUCH AS AN ASSESSMENT OF THE AVAILABILITY OF FRESHWATER GLOBALLY (AS PER ERIC WOOD'S TALK).

3. WE COULD PURSUE BOTH OF THE ABOVE APPROACHES.

4. WE COULD DO NOTHING OR PROCEED WITH GROUPS LAUNCHING INITIATIVES THAT SUIT THEIR OWN INTERESTS IN A UNCOORDINATED WAY.

ON WHAT BASIS SHOULD WE SCREEN OUR OPTIONS?

1. WE SHOULD DO SOMETHING THAT WILL MOVE THE WATER CYCLE COMMUNITY FORWARD IN A UNITED WAY.

2. WE SHOULD SELECT SOMETHING THAT WILL INVOLVE A PROCESS WHEREBY WE CAN HAVE A SUSTAINED FOCUS ON WATER CYCLE MEASUREMENTS AND WE CAN CONTINUE TO SHOW NEW BENEFITS TO NWP AND APPLICATIONS AS WE PROCEED.

3. WE SHOULD DEVELOP APPROACHES THAT PROMOTE INTEGRATION BETWEEN SYSTEMS, COUNTRIES AND DISCIPLINES.

HOW SHOULD WE PURSUE THE SELECTED PATH? …..THROUGH CEOS (COMMITTEE ON EATH OBSERVING SATELLITES)?

CEOS HAS POTENTIAL TO SUPPORT AN INITIATIVE TO DEVELOP A CONSTELLATION OF SURFACE WATER MEASUREMENTS.

Ocean Surface Topography NOAA&EUMETSAT, ESA, CNES, ISRO, NASA *Sustaining a fundamental climate data record for global sea level and ensuring continuity of service to operational and research users*	**Land Surface Imaging** USGS + Multiple CEOS agencies *Ensuring continuity of key land surface observations – including Landsat-class observations – for multiple GEOSS Societal Benefit Areas, including Agriculture.*
Precipitation (GPM) CAST/NRSCC, ESA, NASA and JAXA… *Addressing Task AR-06-10 of the GEOSS 10 Year Implementation Plan*	**Atmospheric Chemistry** NASA + Multiple CEOS agencies *Contributing multiple Fundamental Climate Data Records to GEOSS Task CL-06-02*

THIS ROUTE WOULD TAKE US BEYOND SOLVING EVERYTHING AT THE NATIONAL LEVEL AND GOING FULLY INTERNATIONAL.

GOALS OF THE PRECIPITATION CONSTELLATION

- To provide a framework for implementation and monitoring of GEO 2006 Work Plan task (AR-06-10)
  - *Advocate and facilitate the timely implementation of the Global Precipitation Measurement (GPM) mission and encourage more nations to contribute to the GPM constellation*

- To initiate and sustain an accurate and timely global precipitation data record including a Fundamental Climate Data Record essential for understanding the integrated weather/climate/ecological system, managing freshwater resources, and monitoring and predicting high-impact natural hazard events.

CONSTELLATIONS INVOLVE GLOBAL PARTNERSHIPS

- **Study Lead agencies:**
  - Japan - JAXA (Riko Oki, oki.riko@jaxa.jp) & USA - NASA (Steven Neeck, steven.neeck@nasa.gov)

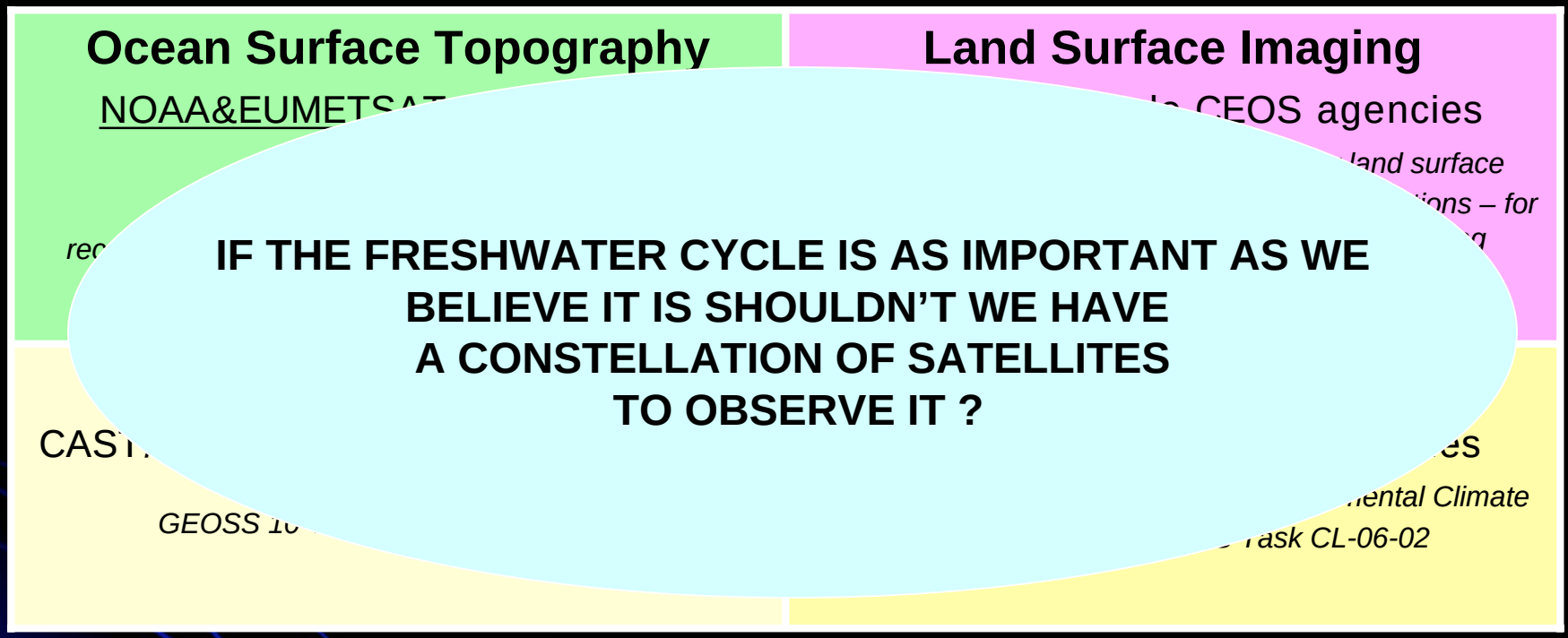
- **Space agency participants:**
  - France - CNES: Didier Renaut, didier.renaut@cnes.fr (To be confirmed)
  - India - ISRO: Raju Garudachar, raju_garudachar@hotmail.com (To be confirmed)
  - Brazil - AEB: Raimundo N. Fialho Mussi, mussi@aeb.gov.br (To be confirmed)
  - Europe - ESA: Einar-Arland Herland, einar-arland.herland@esa.int
  - China - CAST/NRSCC: Point of contact (To be confirmed)
  - USA - NOAA: Ralph Ferraro, ralph.r.ferraro@noaa.gov (To be confirmed)
  - Europe - EUMETSAT: Johannes Schmetz, Johannes.Schmetz@eumetsat.int (To be confirmed)
  - Canada - Canadian Space Agency: Point of contact (To be confirmed)

Scope of Study

- The Constellation study will aim to identify the key points of agreement which will be required to ensure the user benefits from the space agency co-operation are realised in practice. These agreements can be expected to address:
  - the framework and systems for data and product access and exchange;
  - arrangements for interoperability in data, products and services;
  - inter-operability in data processing, archiving and dissemination,
  - space-segment commonalities including sensor specification and satellite system specifications (data transmission, orbit, etc.)
- The approach will be results-focused, identifying what steps are necessary by space agencies (and other groups responsible for product generation, in-situ observations etc) to develop the target data sets and information services.

HOW SHOULD WE PURSUE THE SELECTED PATH?

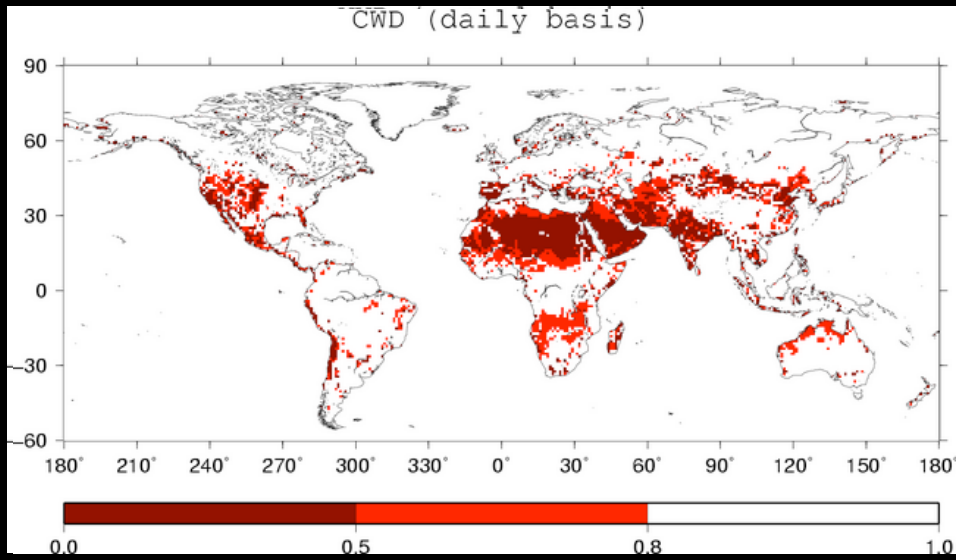
CEOS HAS POTENTIAL TO SUPPORT AN INITIATIVE TO DEVELOP A CONSTELLATION OF SURFACE WATER MEASUREMENTS.



THIS ROUTE WE TAKE US BEYOND SOLVING EVERYTHING AT THE NATIONAL LEVEL AND FULLY GOING INTERNATIONAL.

…. THROUGH GEWEX?

GEWEX COULD PROVIDE THE SCIENTIFIC FRAMEWORK FOR A BROAD OVER-ARCHING WATER CYCLE STUDY THAT WOULD PROVIDE JUSTIFICATION FOR DEVELOPING AND IMPLEMENTING AN EXPANDED WATER CYCLE MONITORING CAPABILITY THAT WOULD RELY ON SATELLITES, IN SITU DATA AND HYDROMETEOROLOGY. POTENTIAL QUESTIONS COULD DEAL WITH: IMPROVEMENTS IN ESTIMATES OF THE COMPONENTS OF THE WATER CYCLE COULD BE USED TO OBTAIN SECULAR CHANGES IN THE AVAILABILITY OF FRESHWATER.



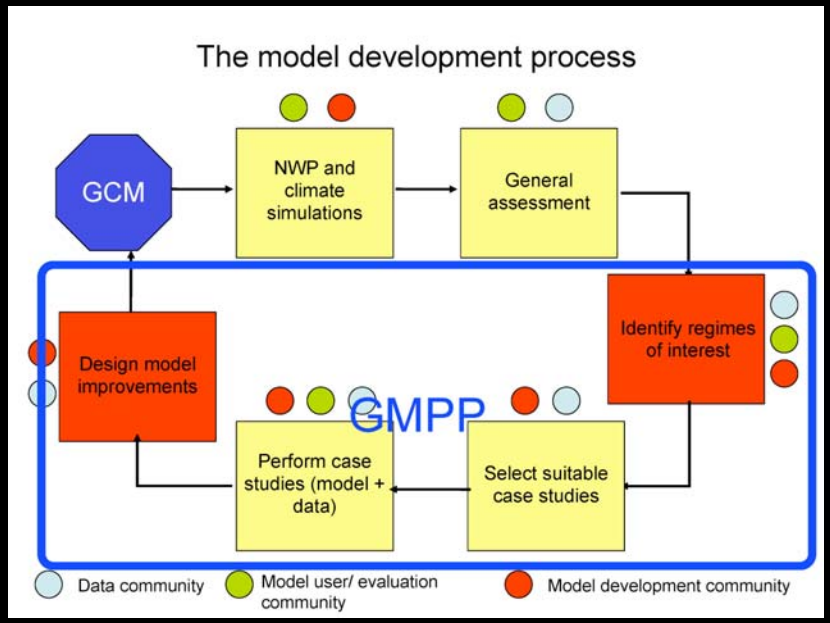
RMS Uncertainties for Radiative Measurements (Ohmura et al, 1998, BAMS; Michalsky et al., 1998; Shi and Long, 2002, Dutton et al., 2001; Ells Dutton personal comm.)

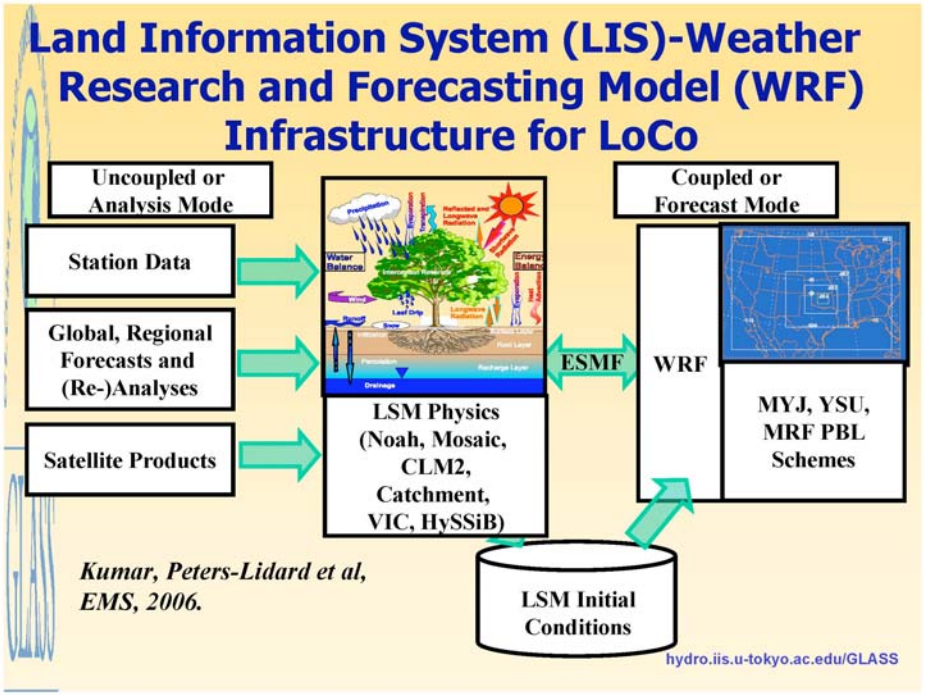
Quantity (Instrument)	1 Minute Avg. (1 Hz sampling) (W m^{-2})	1 Hour (W m^{-2})	1 Day (W m^{-2})	1 Month (W m^{-2})	1 Year (W m^{-2})	Therm-al Offset
LW Broadband (pyrgeometer)	10	5	3 -- 5	3 -- 5	3 -- 5	---
SW Broadband Global (direct+diffuse, pyranometer)	10 -- 25 (5%)	8 -- 20	5 -- 15	5 -- 15	5 -- 15	up to -3%
SW Broadband Direct (NIP)	1% or 2	1% or 2	1% or 2	1% or 2	1% or 2	---
SW Broadband Diffuse (shaded pyranometer)	5 -- 20	5 -- 15	5 -- 15	5 -- 12	5 -- 12	up to -10
SW Broadband Total (shaded pyranometer + NIP)	5 -- 20	5 -- 15	5 -- 15	5 -- 12	5 -- 12	up to -10

GEWEX IS STRIVING TO ESTIMATE KEY WATER AND ENERGY CYCLE WITHIN A CERTAIN LEVEL OF ACCURACY AND TO CLOSE THE OVERALL BALANCE TO WITHIN <~5%

OTHER RELEVANT QUESTIONS THAT GEWEX ADDRESSES

ASSESSMENT OF GCM ABILITIES TO SIMULATE CERTAIN ASPECTS OF THE GLOBAL WATER CYCLE AND WHETHER IT IS INTENSIFYING (OR ACCELERATING) BASED ON DATA FROM THE PERIOD OF SATELLITE MEASUREMENTS.

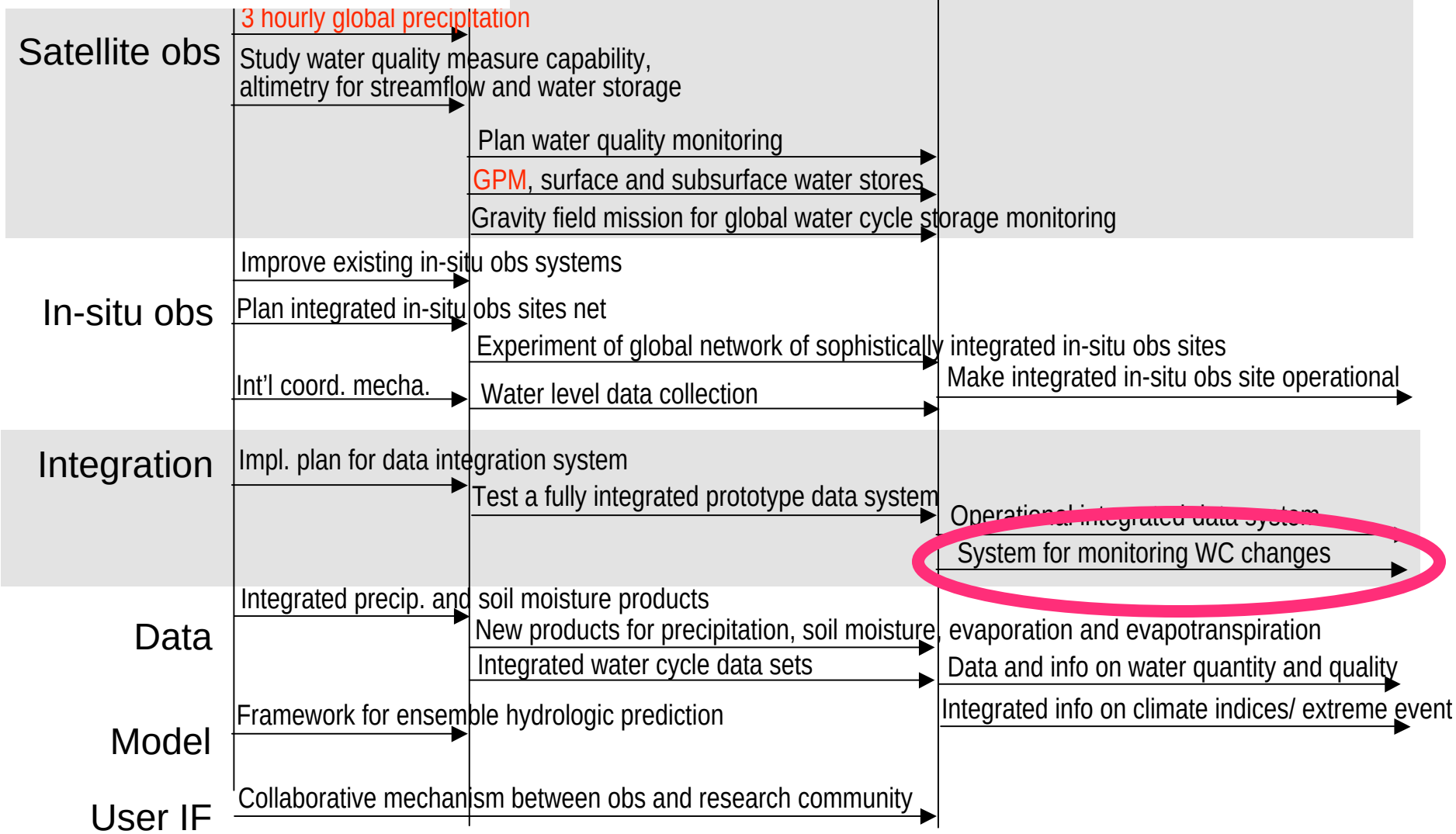




DEVELOPMENT OF THE ASSIMILATION CAPABILITIES TO PROVIDE THE FORECAST SYSTEM WITH THE BEST INITIALIZATION DATA AVAILABLE.

Time sequence of GEOSS IP Targets - Water

GLOBAL EARTH OBSERVING SYSTEM OF SYSTEMS



WE ALSO NEED A PROCESS FOR DECIDING BETWEEN THESE (AND OTHER) OPTIONS.

COMMENTS, SUGGESTIONS?……